DO NOT ENTER: /RM/

01/29/2009

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	**Customer No.: 27182**
Peter H. McDonald	**Confirmation No.: 4994**
Application No.: 10/643,986	Group Art Unit: 1795
Filed: August 20, 2003	Examiner: R. G. McDonald
Title: METHOD OF TREATING SPUTTERING TARGET TO REDUCE BURN-IN TIME AND SPUTTERING TARGET THEREOF AND APPARATUS THEREOF	Docket No. 21295

AFTER FINAL AMENDMENT
PURSUANT TO 37 C.F.R. §1.116

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in complete response to the Official Action issued October 17, 2008. The Examiner set a three-month period for response. Given that the January 17th was a Saturday, and January 18-20 were Federal holidays, this After Final Amendment is due on January 21, 2009.

Amendments to the Claims appear on Page 2 of this paper.

Remarks appear on Page 6 of this paper.

IN THE CLAIMS:

Kindly amend claims 1 and 10, as shown below:

1. (Currently Amended) A method of dry treating a target surface prior to packaging the target for subsequent use in a sputtering deposition process, comprising the steps of:

a) preparing a target assembly and securing said target assembly in a vacuum chamber of a magnetron sputtering apparatus;

b) energizing the magnetic component of the magnetron sputtering apparatus with a power between about 0.2 kW and about 4 kW for a period of time between about 4 and about 30 minutes to produce a surface dry treatment of a sputtering ion plasma ~~on an exposed surface~~ to treat the primary sputter erosion zone of the target to effectively reduce inherently undesirable impurities on the ~~exposed surface~~sputter erosion zone~~, thereby reducing the subsequent burn-in time by at least 10% as compared to an untreated target~~;

c) removing the treated target assembly from the magnetron sputtering apparatus;

d) machining substantially the entire surface of the target to the level of the treated primary sputter erosion zone, thereby reducing the subsequent burn-in time by at least 10% as compared to an untreated target, wherein said burned-in target effectively reduces the R_s uniformity of the wafer at least 10%; and

~~d~~e) preparing and packaging the target assembly for subsequent use in the sputtering deposition process.

2. (Previously Presented) The method of claim 1 wherein the magnetron sputtering apparatus is rotatable and the magnetic component of the magnetron sputtering apparatus is disposed on less than a 180° arc measured at the axis of rotation of the apparatus so as to produce a rotatable sputtering ion plasma on the exposed surface of the target.

3. (Previously Presented) The method of claim 1 wherein the exposed surface is treated for a time period between about 8 and about 10 minutes and a power of between about 0.2 kW and about 0.4 kW.

4. (Previously Presented) The method of claim 3 wherein the exposed surface is treated in an inert atmosphere.

5. (Previously Presented) The method of claim 4 wherein the inert atmosphere is argon.

6. (Original) The method of claim 1 wherein after removing the target assembly from the magnetron sputtering apparatus in step c), at least the surface treated portion of the target assembly is placed in an enclosure to protect it during storage and shipment.

7. (Previously Presented) The method of claim 6 wherein the enclosure is metallic and the metallic enclosure containing the target assembly is further placed into a different enclosure.

8. (Previously Presented) The method of claim 1 wherein the target material is selected from the group consisting of titanium, aluminum, copper, molybdenum, cobalt, chromium, ruthenium, rhodium, palladium, silver, osmium, iridium, platinum, gold, tungsten, silicon, tantalum, vanadium, nickel, iron, manganese, germanium, or alloys thereof.

9. (Original) The method of claim 2 wherein the magnetic component is FeNdB.

10. (Currently Amended) A method of dry treating a target surface prior to initial use of the target in a sputtering deposition process, the method comprising the steps of:

a) preparing a target assembly and securing said target assembly in a vacuum chamber of a magnetron sputtering apparatus;

b) energizing the magnetic component of the magnetron sputtering apparatus with a power between about 0.2 kW and about 4 kW for a period of time between about 4 and about 30 minutes to produce a surface dry treatment of a sputtering ion plasma ~~on an exposed surface~~ to treat the primary sputter erosion zone of the target to effectively reduce inherently undesirable impurities on the ~~exposed surface~~sputter erosion zone;

c) removing the treated target assembly from the magnetron sputtering apparatus;

d) machining substantially the entire surface of the target to the level of the treated primary sputter erosion zone, thereby reducing subsequent burn-in time by at least 10% as compare to an untreated target, wherein said burned-in target effectively reduces the R_S uniformity of the wafer by at least 10%;

d) packaging the target assembly for subsequent use in ~~a~~ the sputtering deposition process;

e) assembling the target assembly into a sputtering apparatus to coat a substrate; and

f) sputtering the target assembly~~ to burn-in the target assembly wherein the burn-in time is reduced by at least 10% compared to an untreated target~~.

11. (Previously Presented) The method of claim 10 wherein the exposed surface is treated for a time period between about 8 and about 10 minutes and a power of between about 0.2 kW and about 0.4 kW.

12. (Previously Presented) The method of claim 11 wherein the target material is selected from the group consisting of titanium, aluminum, copper, molybdenum, cobalt, chromium, ruthenium, rhodium, palladium, silver, osmium, iridium, platinum, gold, tungsten, silicon, tantalum, vanadium, nickel, iron, manganese, germanium, or alloys thereof.

Claims 13-20 (Canceled).

REMARKS

Entry of the foregoing, and consideration of the subject matter identified in caption, as amended pursuant to 37 C.F.R. §1.116, and in light of the remarks which follow are respectfully requested.

As correctly noted in the Office Action Summary, claims 1-12 are pending in the application and are under consideration. By the above amendments, claims 1 and 10 has been revised to recite the formation of a primary sputter erosion zone with reduced impurities, thereafter machining the remainder of the target to produce a target which reduces the R_s uniformity of the formed wafer by at least 10%. Support may be found at least at page 7, paragraphs 16 and 17. Entry of these amendments is respectfully requested.

Claims 1, and 3-8 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Dunlop et al (U.S. Patent No. 6,030,514) in view of Marton et al (U.S. Patent Application Publication 2003/0059640 A1). The claims, as amended, cannot be rejected on this basis.

Based on a complete understanding of the present invention, it is respectfully submitted that the claims cannot properly be rejected under §103(a) based on the teachings of Dunlop et al and Marton et al. The combination of features set forth in independent claim 1, as now presented, are simply not disclosed or suggested by the applied documents.

The present invention relates to a method of dry treating a sputtering target to achieve an enhanced finish on the surface that effectively reduces burn-in time of the target by at least 10% as compared to an untreated target.

In one aspect of the invention, and as set forth in independent claim 1, a method of dry treating a target surface prior to packaging the target for subsequent use in a sputtering deposition process is provided. The method includes the steps of: (a) preparing a target assembly and securing said target assembly in a vacuum chamber of a magnetron sputtering apparatus; (b) energizing the magnetic component of the magnetron sputtering apparatus with a power between about 0.2 kW and about 4 kW for a period of time between about 4 and about 30 minutes to produce a surface dry treatment of a sputtering ion plasma to treat the primary

sputter erosion zone of the target to effectively reduce inherently undesirable impurities on the sputter erosion zone; (c) removing the treated target assembly from the magnetron sputtering apparatus; (d) machining substantially the entire surface of the target to the level of the treated primary sputter erosion zone, thereby reducing the subsequent burn-in time by at least 10% as compared to an untreated target, wherein said burned-in target further effectively reducing the R_s uniformity of the wafer at least 10%; and (e) preparing and packaging the target assembly for subsequent use in the sputtering deposition process.

Dunlop et al relates to a method of reducing sputtering conditioning time or so called burn-in and a target assembly thereof. Col. 1 lines 6-9. For example, Dunlop et al does not disclose or fairly suggest preparing the surface of a sputter target by energizing the magnetic component of the magnetron sputtering apparatus with a power between about 0.2 kW and about 4 kW for a period of time between about 4 and about 30 minutes to produce a surface dry treatment of a sputtering ion plasma on an exposed surface of the target to effectively reduce inherently undesirable impurities on the exposed surface, thereby reducing the subsequent burn-in time by at least 10% as compared to an untreated target <u>prior</u> to its utilization in the a deposition process. In addition, Dunlop et al does not provide for the burn-in of an erosion zone, followed by machining of the remainder of the target surface, nor the Rs uniformity of the wafers formed by the burned-in target. In this regard, note the experimental data shown in Applicant's example and Table 1, which tablates the improved results.

Marton et al has been relied on for the purported disclosure of the processing conditions in target conditioning. Official Action at page 3. However, Marton et al fails to cure the deficiencies in Dunlop et al for several reasons.

Marton et al relates to shape memory and superelastic alloys and vacuum deposited metallic materials. Specifically, Marton et al is directed to nickel-based alloys fabricated by vacuum deposition technologies, and which exhibit shape memory effect and/or superelastic behavior. Page 1, second paragraph. Marton et al, however, does not teach or fairly suggests conditioning dedicated regions of a sputter target surface prior to the burn-in. Instead the conditioning treatment is indeed the burn-in part of the process. In other words, Marton et al does not

disclose the conditioning of the system as a separate and discrete step, <u>prior</u> to performing a deposition process. In this regard, Marton et al discloses the entire target as being exposed to the plasma, with a dummy substrate therein. See page 7, paragraph 74. Furthermore, the exposure to the plasma during the target conditioning is a burn-in step within the deposition process. See page 7, paragraph 67 <u>et al</u>.

In addition, Marton et al does not follow-up with machining the target surface, after the burn-in of the erosion zone, because the entire surface is treated at once. What's more, there is absolutely no disclosure or suggestion in Marton et al that the targets produces would effectively reduce the R_s uniformity of the wafers by at least 10%. Thus, clearly one of ordinary skill in the art would not look to combine the disclosures of Dunlop et al with that of Marton et al, due to the disparate nature of the disclosures (i.e., the preparation of the target). Furthermore, the conditioning of Marton et al does not aim to nor achieves a 10% reduction to the burn-in time. Therefore, even if combined in the manner suggested, albeit improperly, one of ordinary skill would not arrive at the claimed invention. For at least the foregoing reasons, withdrawal of this rejection is in order and it is respectfully requested.

Claim 2 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Dunlop et al in view of Marton et al and further in view of Ding et al (U.S. Patent Application Publication 2003/0089601). This rejection is traversed.

Dunlop et al and Marton et al have been discussed in detail above. Ding et al relates Ding et al disclose an array of auxiliary magnets positioned along sidewalls of a magnetron sputter reactor on a side towards the wafer from the target. See Abstract. Ding et al has been applied for allegedly disclosing a sputtering apparatus including a rotating magnetron system "comprises less than 180 arc". See Official Action at page 4.

Ding et al simply does not cure the deficiencies in either of Dunlop et al or Marton et al. Specifically, Ding et al does not disclose or fairly suggest conditioning of the target as a separate and discrete step, prior to packaging and shipping the target for subsequent use in a deposition process, nor the effective

reduction in R_s uniformity of the wafer. Thus, for the foregoing reasons, withdrawal of this rejection is in order and it is respectfully requested.

Claims 9 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Dunlop et al in view of Morton et al and further in view of Arai et al (U.S. Patent No. 6,187,457). This rejection is traversed for the following reasons.

Dunlop et al and Morton et al have been discussed above. Arai et al relates to an electroluminescent light emitting device using an organic compound in which an electron injecting electrode for supplying electrons to a light emitting layer is provided thereon with a sealing film. See Col. 1, lines 5-11. Arai et al has been applied for allegedly disclosing the use of FeNdB magnet. However, Arai et al does not even concern a magnetic component to be utilized in a sputtering system, much less cure the deficiencies in Dunlop et al and Morton et al. Thus, withdrawal of this rejection is respectfully requested.

Claim 10-12 stand rejected under 35 U.S.C. §103(a) as allegedly being obvious over Dunlop et al in view of Morton et al and further in view of Pavate et al (U.S. Patent No. 6,001,227). This rejection is traversed for the following reasons.

In accordance with the Official Action, Dunlop et al allegedly implies "placing the target in a sputtering chamber and burning-in the target." Official Action at page 7. As discussed above, Dunlop et al does not even remotely discuss the particular steps taken to surface treat the target before its utilization in a deposition process, much less the reduction of burn-in time by at least 10%, as presently claimed. Pavate et al has been relied on for the purportedly curing the deficiencies in Dunlop et al and Morton et al for allegedly "explicitly teach surface treatment and packaging." Official Action at page 7. This statement is only correct to the extent that surface treatment is performed prior to packaging the target and ultimately using same. In this regard, Morton only teaches a surface treatment step 306 by polishing, and cleaning of the target ultrasonically prior to packaging so as to remove any surface roughness that may result in arcing. See col. 11, lns. 46-63. Thus, clearly Morton does not teach the steps of creating a plasma to clean the surface, based on the claimed parameters, nor does

packaging so as to remove any surface roughness that may result in arcing. See col. 11, lns. 46-63. Thus, clearly Morton does not teach the steps of creating a plasma to clean the surface, based on the claimed parameters, nor does it disclose a reduction in the burn-in time by at least 10% as compared to an untreated target. Accordingly, even if combined in the manner suggested by the Examiner one of ordinary skill in the art would not arrive at the claimed invention. Withdrawal of this rejection is in order and it is respectfully requested.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

If there are any questions concerning this paper, or the application in general, the Examiner is invited to telephone the undersigned at his or her earliest convenience.

Respectfully submitted,

I. Sbwrz

Iurie A. Schwartz
Attorney for Applicant
Reg. No. 43,909

Praxair, Inc.
Corporate Law Department
39 Old Ridgebury Road
Danbury, CT 06810-5113
Phone: (203) 837-2115

Date: January 21, 2009